The Effect of Human Immunodeficiency Virus on Endodontic Treatment Outcome

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Abstract

The purpose of this retrospective study was to compare periradicular healing between HIV positive and negative patients 1 yr after endodontic treatment of necrotic teeth with chronic apical periodontitis. The preoperative radiographs of 33 patients diagnosed with HIV and 33 medically healthy patients were scored by three endodontists using the Periapical Index (PAI) Scoring Method. Follow-up radiographs were taken 12 months after endodontic treatment and also scored with the PAI. The degree of healing, as determined by the mean PAI change, was compared between the two groups. There were no statistically significant differences between the two with respect to the degree of periradicular healing. In addition, the three evaluators were found to have very high inter-examiner agreement. The results indicate that clinicians do not have to alter their expectations for healing and resolution of periradicular lesions based solely on the HIV status of their patients.

Key Words

HIV, periapical index scoring method (PAI), retrospective study, endodontic outcome, periradicular healing, periapical healing

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The main objective of nonsurgical endodontic therapy is to prevent or eliminate apical periodontitis. The prevention of periradicular disease is achieved through extirpation and debridement of vital, irreversibly inflamed pulpal tissue and complete obturation of the prepared canal system. The elimination of pre-existing disease necessitates another procedural goal: the significant reduction of the microbial content within the canals, as studies have shown bacteria and their byproducts not only cause, but also maintain, periradicular pathosis (1–3).

Although ideally it is best to completely eliminate all bacteria from the canals of teeth with periradicular lesions, it has been shown that even thorough biomechanical instrumentation is unable to sterilize the canal system (4–6). With teeth exhibiting both pulp necrosis and chronic periradicular lesions, bacteria have also been identified on the external surface of the root as well as the periradicular environment (7–9). Without the possibility of completely eliminating all bacteria both intra and extraradicularly with nonsurgical endodontic therapy, the clinician is forced to simply reduce the critical mass of microorganisms and attempt to entomb those remaining with both a fluid tight root canal obturation and a permanent coronal restoration while depriving them of nutrition and space to multiply (10, 11).

The persistence of viable bacteria in teeth with apical periodontitis following endodontic therapy might account for the poorer prognosis of these cases. Studies of such cases have shown success rates are about 10 to 20% lower than cases without such lesions (12–14). Despite this, the fact that 70 to 80% of these cases are deemed successful implies the host immune system is able, in the majority of cases, to presumably eliminate the microbes remaining after treatment. In essence, the goal of therapy for necrotic teeth should be to reduce the intra and extraradicular microbial content beyond a critical level that allows the host immunological defense mechanisms to successfully resolve the remaining infection and allow complete healing.

A potential problem with this treatment philosophy arises when treating patients who are immunocompromised. A recent study by Fouad and Burleson found patients with diabetes had a significantly lower long-term success rate following endodontic therapy on teeth with periradicular lesions compared to healthy patients (15). Their retrospective study involved 540 cases with two or more years of follow-up. They found no differences in success rates between the two groups when teeth without discernable periradicular pathosis were compared, directly implicating the root canal infectious process in accounting for the observed differences with necrotic cases. They speculated that both the diabetic patient's alteration in immune function as well their propensity to harbor a more pathogenic microbial flora contributed to the poorer prognosis for periradicularly involved teeth in these patients (16). Despite its direct clinical significance, this is one of the few studies to date showing a correlation between compromised immune function and treatment outcome in endodontic therapy. Although not as prevalent as diabetes, the human immunodeficiency virus (HIV) and associated acquired immunodeficiency syndrome (AIDS) may be equally detrimental to the prognosis of endodontic treatment.

Nearly 1 million people are currently living with HIV/AIDS in North America, making it a significant source of morbidity and economic expense throughout the region (17). Although patients with HIV infection are considered to be at higher risk of developing opportunistic infections than people without the disease, the overall incidence of such infections has been declining over the past 10 yr mainly because of the introduction of highly active antiretroviral therapy (HAART) (18). The infections that

continue to occur do so at low CD4+ T lymphocyte counts, and persons whose CD4+ counts have increased in response to HAART are at low risk for developing these infections, indicating a high degree of immune reconstitution associated with the new therapy (19). Despite this, many of our patients are either unaware of their current CD4+ count, are not optimally responsive, or are not completely compliant with their therapeutic regimen, potentially putting them at higher risk of immunosuppression and reducing the potential benefits associated with therapy.

Few data, however, are available on the pathophysiology and clinical progression of apical periodontitis or the prognosis of endodontic treatment in patients with HIV. A retrospective study performed by Cooper in 1993 assessed the short-term (3 months posttreatment) success of endodontic treatment on HIV positive verses HIV negative patients (20). The study was primarily looking at the incidence of complications following treatment but did define success as a lack of clinical signs or symptoms of apical disease at the 1 and 3-month follow-up visits. No significant differences were found between the two groups in terms of short-term success and incidence of complications and identified only one HIV positive patient to have any problems following treatment that required further therapeutic intervention. Overall he concluded root canal therapy could be carried out on HIV positive patients following standard procedures and without the need for antibiotic prophylaxis. Although this research was done before the era of HAART, it utilized such a short time interval following treatment to determine outcome that the reported success rates carry very little importance. The only pertinent information is the fact that HIV patients did not experience any more immediate postoperative complications compared to healthy patients.

The idea that immunocompromised patients, specifically those infected with HIV, would carry a poorer prognosis for endodontic treatment of teeth with periradicular lesions is derived mostly from histological studies, case reports, and basic immunological principles. It is well accepted that T-cells play an important role in the development, progression, and resolution of periradicular lesions (21–23). Recent research has determined in healthy patients that CD4+ T-cells, which are the primary target of HIV, are most predominant in the early phases of periradicular lesion development whereas CD8+ T-cells, which are relatively unaffected by HIV, become more prominent in the chronic phases of the lesion as the CD4+ cells gradually decrease in number (24–26). One case report involving extraction of teeth with chronic apical periodontitis on a patient diagnosed with AIDS revealed interesting immunopathological results upon histological analysis. The authors found the periradicular lesions to be almost devoid of CD4+ T-cells with an overabundance of CD8+ cells (27). They reasoned that the relative lack of T-Helper cells is probably an important reason for the poor defense against various microbial agents and may contribute to delayed healing of apical periodontitis after endodontic treatment. Considering CD4+ T-cells play a vital role in activating B-cells, macrophages and other T-cells, it is reasonable to suspect patients with low counts of these cells would have difficulty mounting an effective immunological defense against microorganisms invading from the root apex.

The purpose of this retrospective study was to compare periradicular healing between HIV positive and negative patients 1 yr after endodontic treatment of necrotic teeth with chronic apical periodontitis.

Materials and Methods

Patient Data

This study entailed a retrospective design in which the experimental group included patients diagnosed with the human immunodeficiency virus infection. These patients were all under a physician's care and were receiving some regimen of antiretroviral therapy at the time endodontic treatment was completed. In addition, most reported to have viral loads below the limits of assay detection and near normal CD4+ counts, although exact and up to date laboratory data was not available in each patient's clinical record and thus was not included in this study. The control group included patients who had not been diagnosed with HIV. A total of 66 patients were involved all together (33 in each group). All patients were nondiabetic and free of any other immunocompromising medical conditions. The primary criterion for the inclusion of subjects in both groups was the presence of radiographically observable apical periodontitis (minimum of 2 × 2 mm in size) on restorable, necrotic single or multi-rooted teeth. Patients were excluded from the study if the tooth in question had been previously endodontically treated or if it was extracted sometime after treatment but before the follow-up examination. Overall, one patient in each group was excluded because of an extraction of the study tooth. In both cases, the reason for extraction was the presence of a vertical root fracture. Patients presenting to the follow-up examination without some form of acceptable, permanent coronal seal were also excluded. All patients involved in this study were male and between the ages of 18 and 60. The mean age for the HIV positive group was 51.5, whereas for the control group was 50.0. The protocol was approved by the Institutional Review Board at the University of Illinois at Chicago (protocol #2002-0347).

Treatment and Follow-up Protocols

All patients were treated from 2000 to 2003 by postgraduate residents at the University of Illinois at Chicago College of Dentistry. Cases were completed in at least two visits with the placement of calcium hydroxide paste as an intracanal medicament between visits. Patients generally did not receive supplemental antibiotics unless they had to receive antibiotics before treatment for a systemic reason or if they had a spreading periradicular infection, usually characterized by fever, malaise, lymphadenopahty, or an extraoral swelling. After completion of treatment the patient was referred back to either the predoctoral or Ryan White clinics for restoration by faculty, postdoctoral residents, or predoctoral students. Follow-up periradicular radiographs were taken 12 months following therapy to assess outcome.

Evaluating Treatment Outcome

Radiographic evaluation was used to assess the degree of healing after therapy. Preoperative radiographs were compared to those taken at the 1-year follow-up examination. The Periapical Index (PAI) Scoring System was used to evaluate the presence, absence or change in the radiolucent lesions of the periradicular tissues. It is a simplified version of the radiographic method of interpretation devised by Orstavik and consists of a five-point ordinal interpretation scale made up of five line drawings and corresponding radiographs (28). The scores are based on a correlation with inflammatory periradicular status confirmed by histologic studies (29). Two calibration sessions were conducted with three board-certified, faculty endodontists before the study radiographs were scored. Both initial and follow-up radiographs were evaluated one at a time in random order and in a blinded manner on two separate occasions, at an interval of 2 to 3 weeks. This allowed for the evaluation of intra- and inter-examiner reliability. The three scores for each preoperative and postoperative radiograph were averaged and used to determine the degree of healing. In the case of multi-rooted teeth, the highest score given to one individual root was the score assigned to that tooth.

Statistical Analysis

Independent *t* tests were used to compare the degree of healing between the two groups (as determined by the change in the mean PAI score from the preoperative to 12 month postoperative radiograph). In